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PSEUDOSCORPION GROUPS WITH BIPOLAR DISTRIBUTIONS: A NEW GENUS FROM TASMANIA RELATED TO THE HOLARCTIC *SYARINUS* (ARACHNIDA, PSEUDOSCORPIONES[1], SYARINIDAE)

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ABSTRACT. A new genus *Anysrius* is proposed for two new species from Tasmania, Australia: *A. chamberlini* (type species) and *A. brochus*. *Anysrius* represents the sister-genus to the northern hemisphere genus *Syarinus* Chamberlin, but males differ in differences in the morphology of sternite II and IV. The biogeographic aspects of the new discovery are examined, and the *Syarinus-Anysrius* clade is considered to represent an ancient relict which evolved prior to the breakup of Pangea during the Mesozoic. This distribution pattern is considered to be 'bipolar' and is compared with that of the pseudoscorpion family Pseudogarypidae, which is also known from Tasmania and the Holarctic.

Recognizable bipolar or amphi-arctic distributions (i.e., where extant taxa occur in northern and southern latitudes but are absent from tropical zones) seem to be uncommon amongst arachnids, with probably one of the most clear-cut examples being the pseudoscorpion family Pseudogarypidae. This family is represented by a sole Tasmanian genus and species, *Neopseudogarypus scutellatus* Morris 1948, six North American species of *Pseudogarypus* Ellingsen 1909, and three Tertiary species of *Pseudogarypus* described from European Baltic Amber (see Harvey 1991a).

Similar distribution patterns were reported for the pseudoscorpion family Syarinidae by Harvey (1996), who briefly discussed the occurrence of a new genus from Tasmania which appeared to be most similar to *Syarinus* Chamberlin 1925 from North America and Europe. I here take the opportunity to examine in more detail the taxonomic and biogeographic anomalies posed by the Tasmanian species, and also examine the presence of sternal modifications in male syarinids.

The material examined during this study is lodged in the following repositories: American Museum of Natural History, New York (AMNH); Australian National Insect Collection, Canberra (ANIC); Florida State Collection of Arthropods, Gainesville (FSCA); Museum of Victoria, Melbourne (NMV); Tasmanian Museum and Art Gallery, Hobart (TMAG); and Western Australian Museum, Perth (WAM). Terminology follows Chamberlin (1931) and Harvey (1992), with measurements being taken to the nearest 0.005 mm.

[1]The name Pseudoscorpiones is used in preference over Pseudoscorpionida or Chelonethida, based upon a directive from CIDA (Anonymous 1996).

TAXONOMY

Syarinidae Chamberlin

Syarinidae Chamberlin 1930: 38; Harvey 1991a: 417 (full synonymy).

Remarks.—The Syarinidae were characterized by Muchmore (1982a, 1982b) and Harvey (1992), but there are several morphological anomalies in some genera which suggest that the family may not be monophyletic. Muchmore (1982b) highlighted the presence of a shortened and lanceolate trichobothrium *t*, a character state found in *Syarinus, Ideobisium* Balzan 1892, *Ideoblothrus* Balzan 1892, *Nannobisium* Beier 1931, *Chitrella* Beier 1932 and *Microblothrus* Mahnert 1985 (Muchmore 1982b; Mahnert 1985; Harvey, pers. obs.), and the new genus described below. However, *t* is acuminate and not particularly shortened in the remaining syarinid genera *Microcreagrina* Beier 1961, *Microcreagrella* Beier 1961, *Hadoblothrus* Beier 1952, *Pseudoblothrus* Beier 1931 and *Troglobisium* Beier 1939 (Muchmore 1982b). The nature of *t* in *Aglaochitra* Chamberlin 1952 is

unknown, as is that of *Chitrellina* Muchmore 1996 due to the loss of both trichobothria in the sole specimen (see Muchmore 1996).

The Australian syarinid fauna consists of two described species of *Ideoblothrus,* numerous undescribed species of *Ideoblothrus* and *Ideobisium* (Harvey 1991b; unpubl. data), and two undescribed species of a new genus from Tasmania, which is clearly unrelated to either *Ideoblothrus* or *Ideobisium.*

The two genera discussed below share a number of significant apomorphic features, which clearly place them as sister-groups. These include: (1) trichobothrium *isb* situated on internal margin of fixed chelal finger; (2) pedipalpal coxa rounded and with 2 setae; (3) junction between femur and patella IV strongly oblique; (4) male sternite IV with one or median cribrate areas.

In order to interpret the similarities and differences between the Tasmanian and Holarctic species, I here fully describe the Tasmanian species and make observations upon some species of *Syarinus.*

Anysrius new genus

Type species.—*Anysrius chamberlini* new species.

Etymology.—The generic epithet is an anagram of *Syarinus,* and is masculine in gender.

Diagnosis.—Distinguished from all Syarinidae, except *Syarinus,* by the presence of trichobothrium *isb* situated on internal face of fixed chelal finger (Figs. 1, 6, 19, 22), apex of pedipalpal coxa rounded and with 2 setae, the strongly oblique junction between femur and patella IV (Figs. 9, 28); subterminal tarsal seta acuminate (Figs. 8, 9, 28); and male sternite IV with median cribrate area (Figs. 16, 29), but apparently without associated glands. *Anysrius* differs from *Syarinus* by male sternite II bearing an external lobe and median cribrate area (Figs. 16, 29), and the single median cribrate area of male sternite IV (Figs. 16, 29).

Description.—*Pedipalps:* Apex of coxa rounded and with 2 setae; chelal fingers somewhat curved; chelal teeth contiguous (Figs. 1–4, 19–21); venom apparatus absent from movable finger; venom duct of fixed finger short (Figs. 1–4, 19–21). Fixed chelal finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Figs. 1, 22); trichobothria *est, et* and *it* situated in distal portion of fixed finger, *eb, esb, ib, isb* and *ist* situated in basal portion of fixed finger; *isb* situated on internal face of fixed chelal finger; *sb, st* and *t* closely spaced near middle of movable finger; *t* lanceolate (Fig. 5). Chelicera (Figs. 11, 24, 25): hand with 5 setae, movable finger with 1 sub-distal seta; lamina exterior and velum absent; flagellum composed of 6 blades, the 4 distal blades with several anteriorly-directed spinules (Figs. 14, 27); galea of ♂ small and usually acuminate (Figs. 12, 24), of ♀ trifurcate with each ramus terminally trifurcate or bifurcate (Figs. 13, 25). Carapace (Figs. 10, 23): subquadrate, with 1 pair of eyes, anterior eyes small and flat, posterior eyes absent. Pleural membrane generally longitudinally striate, although near cephalic region it becomes slightly granulate. ♂ sternite II with median cribrate area and external lobe (Figs. 16, 29); ♂ sternite IV with single median cribrate area (Figs. 16, 29), but apparently without associated glands. Male genital atrium without internal setae. Female genitalia (Figs. 18, 31) with 1 median and 2 small lateral cribriform plates, with very few pores; spermathecae absent. Spiracles simple, with spiracular helix; anterior pair of tracheae long, ramifying into tracheoles when above coxae IV; posterior pair of tracheae short, ramifying into tracheoles almost immediately; spiracular plates with setae. *Legs:* (Figs. 8, 9, 28) Junction between femur and patella I nearly perpendicular; femora I and II without basi-dorsal mound; junction between femur and patella IV strongly oblique; metatarsus and tarsus of all legs separate; subterminal tarsal seta acuminate; arolium slightly shorter than claws.

Included species.—*Anysrius chamberlini* new species and *A. brochus* new species.

Distribution.—Apparently endemic to Tasmania.

Remarks.—Although the two species referred to *Anysrius* below are clearly sister-groups, there may be grounds for the placement of each species in a separate genus. This is solely based upon autapomorphies present in males of each species. In *A. chamberlini,* the male pedipalpal patella bears numerous small specialized blunt setae which are lacking in *Syarinus* and *A. brochus,* and in *A. brochus* the male movable cheliceral finger bears several dorsal protuberances which are lacking in *Syarinus* and *A. chamberlini.* However, the two species share two apomorphies lack-

ing in all other syarinids, including *Syarinus*: male sternite II with an external lobe and a median cribrate area. For this reason, it seems prudent to retain them in a single genus until further species are discovered and until a detailed review of the morphology of members of the genus *Syarinus* can be undertaken (see below).

The external lobe found on male sternite II of *Anysrius* spp. is apparently unique within the Pseudoscorpiones, and its function is completely unknown. It is very weakly sclerotized and although it bears a number of small external pores (Figs. 16, 29), no internal glandular system could be detected which may connect to the lobe.

Anysrius chamberlini new species
(Figs. 1–18)

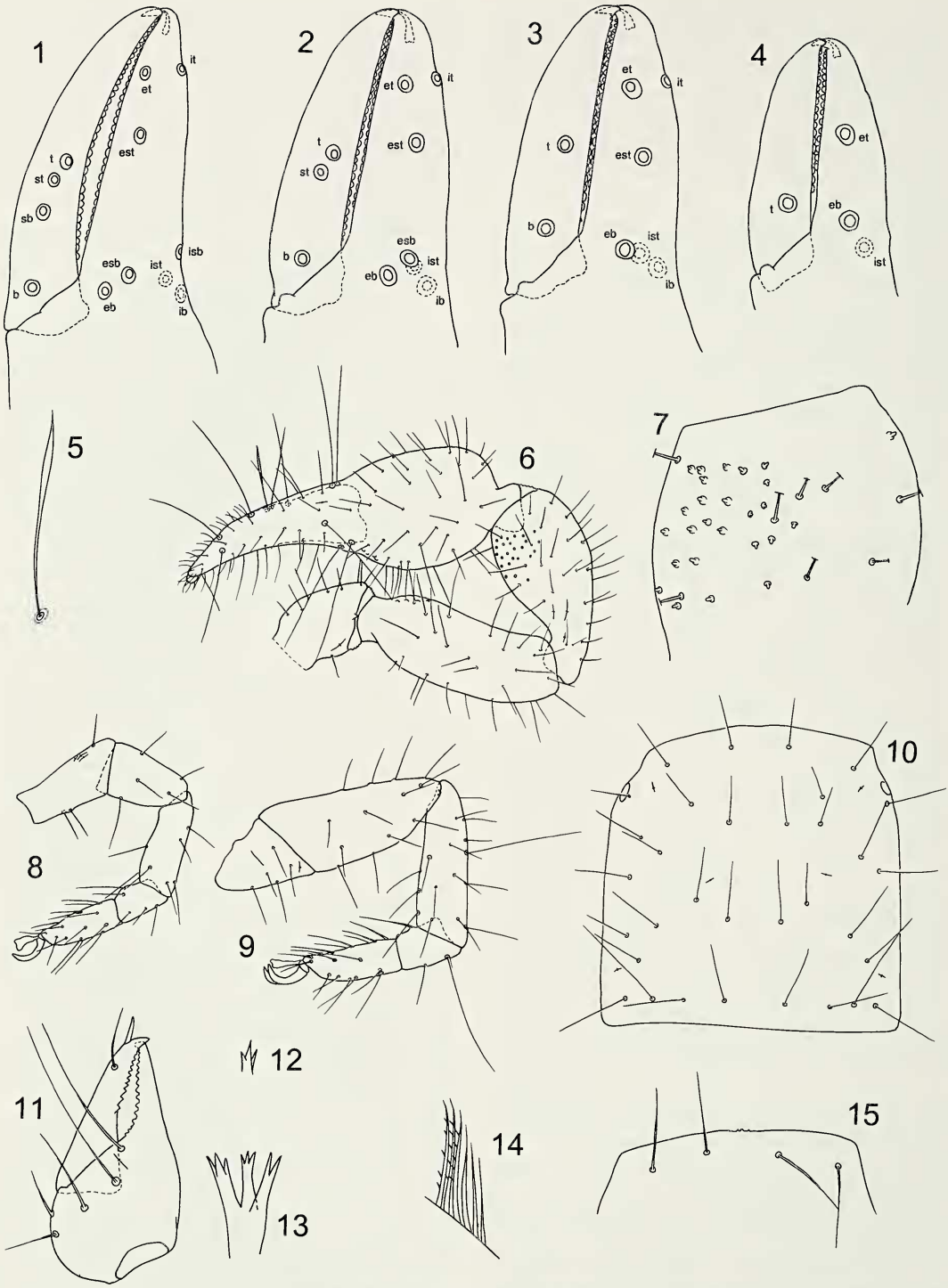
Undescribed genus and species.—Harvey 1990: 158–159, fig. 4; Harvey 1996: 258.

Types.—Male holotype from Frodshams Pass, Tasmania, Australia [42°49′S, 146°23′E], thamnic rainforest litter, 18 November 1988 (P. Greenslade) (ANIC, spirit). Paratypes, all from **Australia:** *Tasmania*: 2♀, 1 tritonymph, same data as holotype (ANIC, spirit); 1♂1♀, 2 km S. of Frodshams Pass, 42°50′S, 146°23′E, rainforest litter berlesate, 24 January 1983 (I.D. Naumann, J.C. Cardale) (ANIC, slides); 1 deutonymph, Frodshams Pass, in rainforest leaf litter, 23 March 1985 (P. Greenslade) (ANIC, spirit); 1 protonymph, Frodshams Pass, 42°49′S, 146°23′E, rainforest leaf litter and log debris, 22 November 1986 (M.S. Harvey, P.K. Lillywhite) (WAM, spirit); 81♀, 2 tritonymphs, 2 deutonymphs, divide between Huon and Florentine Rivers, Scotts Peak Road, 42°48′S, 146°22′E, ex moss, myrtle forest, 3 May 1973 (J.L. Hickman) (TMAG, spirit); 1♀, 1 tritonymph, 1 deutonymph, same data (WAM, spirit).

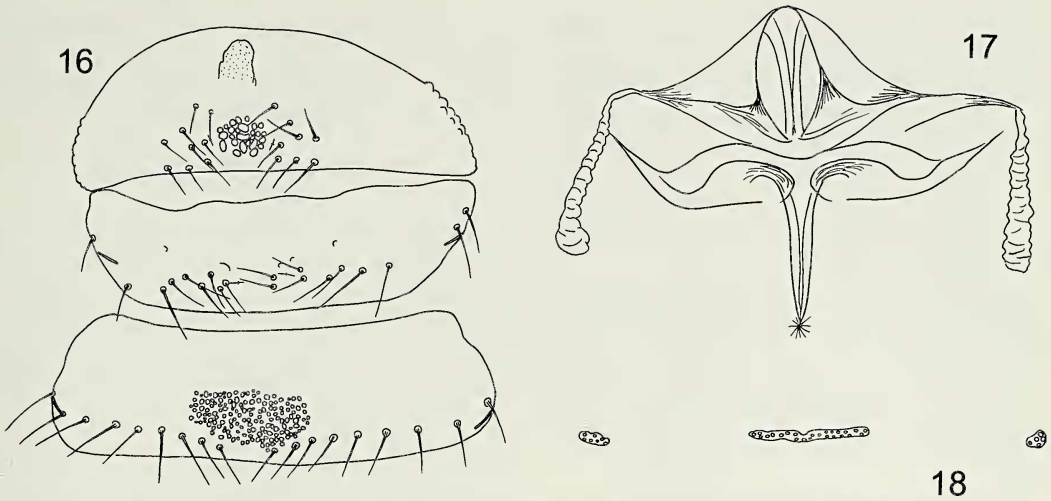
Etymology.—The specific epithet is in honor of Joseph Conrad Chamberlin.

Diagnosis.—Males of *A. chamberlini* differs from those of *A. brochus* by the lack of external teeth on the movable cheliceral finger (Fig. 11), and the presence of *ca.* 25 dorsal specialized blunt setae on the dorsal surface of the pedipalpal patella (Figs. 6, 7). Females differ by the poorly granulate pedipalpal femur and chelal hand.

Description.—*Adults:* Pedipalps and carapace red-brown, legs slightly paler, remainder of body pale. Pedipalps (Fig. 6): apex of coxa rounded and with 2 setae; trochanter 1.96 (♂), 1.89 (♀), femur 2.83 (♂), 2.69 (♀), patella 2.00 (♂), 1.95 (♀), chela (with pedicel) 2.93 (♂), 2.90 (♀), chela (without pedicel) 2.73 (♂, ♀), hand (without pedicel) 1.13 (♂), 1.33 (♀) times longer than broad, movable finger 1.45 (♂), 1.06 (♀) times longer than hand (without pedicel). Anterior face of femur and internal face of chela very slightly granulate; patella with *ca.* 25 dorsal specialized blunt setae (Fig. 7). Fixed chelal finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 1); *est, et* and *it* situated in distal portion of fixed finger, *eb, esb, ib, isb* and *ist* situated in basal portion of fixed finger; *isb* situated on internal face of fixed chelal finger; *sb, st* and *t* closely spaced near middle of movable finger; *t* lanceolate (Fig. 5). Chelal teeth contiguous (Fig. 1), fixed finger with 34 (♂), 30 (♀), and movable finger with 39 (♂), 35 (♀) teeth. Chelicera (Fig. 11): hand with 5 setae, movable finger with 1 sub-distal seta; fixed finger with 14 (♂), 13 (♀) teeth on inner surface; movable finger with 11 (♂, ♀) teeth on inner surface; serrula exterior with 19 (♂, ♀) lamellae; flagellum of 6 blades, the 4 distal blades with several anteriorly-directed spinules (Fig. 14); galea of ♂ small and usually acuminate, but trifurcate on left chelicera of holotype (Fig. 12), of ♀ trifurcate with each ramus terminally trifurcate or bifurcate (Fig. 15). Carapace (Fig. 10) with a total of 32 (♂), 28 (♀) setae, including 4 setae on anterior margin and 8 setae on posterior margin, 1.01 (♂), 0.91 (♀) times longer than broad; 2 small eyes, posterior pair absent. Pleural membrane generally longitudinally striate, although near the cephalic region it becomes slightly granulate. Tergal chaetotaxy: ♂, 10: 11: 12: 15: 14: 14: 17: 15: 13: 13: 5: 2; ♀, 10: 10: 13: 14: 15: 15: 15: 15: 14: 12: 4: 2. Sternal chaetotaxy: ♂, 12: (2)15[0](2): (2)15(2): 12: 16: 16: 16: 15: 12: 7: 2; ♀, 8: (1)14(2): (2)11(2): 13: 15: 14: 14: 14: 12: 6: 2. Genital opercula of ♀ not unusual; those of ♂ with median cribrate area on sternite II and on sternite IV (Fig. 16), sternite II with external lobe (Fig. 16). Male genitalia (Fig. 17) lateral apodeme and lateral rod fused along entire length; ejaculatory canal atrium large; median genital sac undivided; genital atrium without internal setae. Female genitalia (Fig. 18) with 1 me-



Figures 1–15.—***Anysrius chamberlini*** new species, male holotype unless stated otherwise. 1–4, Left chelae, lateral: 1, Male; 2, Tritonymph paratype; 3, Deutonymph paratype; 4, Protonymph paratype; 5, Trichobothrium *t*; 6, Right pedipalp, dorsal; 7, Right pedipalpal patella, showing detail of specialized blunt setae; 8, Left leg I; 9, Left leg IV; 10, Carapace; 11, Left chelicera, dorsal; 12, Galea; 13, Galea, female paratype; 14, Flagellum; 15, Carapace, anterior margin, protonymph.



Figures 16–18.—***Anysrius chamberlini*** new species. 16–17, Male paratype: 16, Genital sternites, ventral; 17, Genitalia, ventral; 18, Genitalia, ventral, female paratype.

dian and 2 small lateral cribriform plates, with very few pores; spermathecae absent. Legs (Figs. 8, 9): moderately stout; leg I with femur 1.25 (♂), 1.32 (♀) times longer than patella; junction between femur and patella I nearly perpendicular; femur + patella IV 3.21 (♂), 3.20 (♀) times longer than deep; junction between femur and patella IV strongly oblique; tibia IV 3.40 (♂), 3.67 (♀) times longer than deep; tibia and metatarsus IV each with single sub-proximal tactile seta; subterminal tarsal seta acuminate; arolium not divided distally, slightly shorter than claws.

Dimensions (mm): Holotype ♂ (paratype ♀): Body length 1.570 (1.920). Pedipalps: trochanter 0.250/0.125 (0.255/0.135), femur 0.410/0.145 (0.430/0.160), patella 0.360/0.180 (0.360/0.185), chela (with pedicel) 0.660/0.225 (0.740/0.255), chela (without pedicel) 0.615 (0.695), hand length (without pedicel) 0.255 (0.340), movable finger length 0.370 (0.360). Chelicera 0.240/0.130 (0.270/0.155), movable finger length 0.175 (0.200). Carapace 0.410/0.405 (0.455/0.500); diameter of eye 0.030 (0.025). Leg I: femur 0.175/0.075 (0.185/0.080), patella 0.140/0.080 (0.140/0.085), tibia 0.160/0.060 (0.175/0.060), metatarsus 0.080/0.050 (0.085/0.050), tarsus 0.130/0.045 (0.130/0.045). Leg IV: femur + patella 0.370/0.115 (0.400/0.125), tibia 0.255/0.075 (0.275/0.075), metatarsus 0.095/0.60 (0.100/0.065), tarsus 0.145/0.055 (0.160/0.055).

Tritonymph: Pedipalps: trochanter 1.78, femur 2.58, patella 1.90, chela (with pedicel) 3.00, chela (without pedicel) 2.79 times longer than broad. Fixed finger with 7 trichobothria, movable finger with 3 trichobothria (Fig. 2); *eb, esb, est, et, ib, ist, it, b, sb* and *t* present, *t* lanceolate and shorter than other trichobothria. Chelicera: galea trifurcate, 2 rami terminally trifurcate, other bifurcate; hand with 5 setae, movable finger with 1 seta; fixed finger with 11 teeth, movable finger with 12 teeth; flagellum composed of 6 blades, the 3 distal blades with several anteriorly-directed spinules. Carapace 0.93 times longer than broad; epistome absent; one pair of small eyes present; with 26 setae including 4 setae on anterior margin and 8 setae on posterior margin. Legs as in adult.

Dimensions (mm): Body length 1.630. Pedipalps: trochanter 0.205/0.115, femur 0.335/0.130, patella 0.285/0.150, chela (with pedicel) 0.585/0.195, chela (without pedicel) 0.545, hand length (without pedicel) 0.280, movable finger length 0.270. Carapace 0.385/0.415.

Deutonymph: Pedipalps: trochanter 1.74, femur 2.50, patella 1.78, chela (with pedicel) 3.03, chela (without pedicel) 2.86 times longer than broad. Fixed finger with 6 trichobothria, movable finger with 2 trichobothria (Fig. 3); *eb, est, et, ib, ist, it, b* and *t* present, *t* lanceolate and slightly shorter than other trichobothria. Chelicera: galea trifurcate, 2 rami terminally divided, 1 ramus bifurcate and 1

trifurcate; hand with 5 setae, movable finger with 1 setae; fixed finger with 9 teeth, movable finger with 6 teeth; flagellum composed of 6 blades, the 4 distal blades with several anteriorly-directed spinules. Carapace 1.13 times longer than broad; epistome absent; eyes absent; with 20 setae, including 4 setae on anterior margin and 4 setae on posterior margin. Legs as in adult.

Dimensions (mm): Body length 0.700. Pedipalps: trochanter 0.165/0.095, femur 0.250/0.100, patella 0.205/0.115, chela (with pedicel) 0.440/0.145, chela (without pedicel) 0.415, hand length (without pedicel) 0.190, movable finger length 0.220. Carapace 0.300/0.265.

Protonymph: Pedipalps: trochanter 1.63, femur 2.06, patella 1.72, chela (with pedicel) 3.15, chela (without pedicel) 3.00 times longer than broad. Fixed finger with 3 trichobothria, movable finger with 1 trichobothrium (Fig. 4); *eb, et, ist* and *t* present, *t* not lanceolate. Chelicera: galea trifurcate, one ramus terminally divided, others simple; hand with 4 setae, movable finger without setae; fixed finger with 7 teeth, movable finger with 7 teeth; flagellum composed of 5 blades, the 3 distal blades with several anteriorly-directed spinules. Carapace 0.93 times longer than broad; an extremely small epistome present, consisting of 3 small, pointed processes (Fig. 15); eyes absent; with 20 setae including 4 setae on anterior margin and 4 setae on posterior margin. Legs as in adult.

Dimensions (mm): Body length 0.620. Pedipalps: trochanter 0.130/0.080, femur 0.175/0.085, patella 0.155/0.090, chela (with pedicel) 0.360/0.115, chela (without pedicel) 0.345, hand length (without pedicel) 0.165, movable finger length 0.195. Carapace 0.250/0.270.

Remarks.—The specialized blunt setae found on the male pedipalpal patella are apparently unique amongst the Pseudoscorpiones, and their morphology suggests they are modified setae rather than cuticular granules. They appear to sit in a small pit, which differs somewhat from the setae found on the pedipalp, since the rim is not as sharply defined. The cuticle from which they arise is otherwise not modified and canals cannot be detected in them. They are completely absent in all nymphs.

Anysrius chamberlini is known only from two, adjacent localities in south-western Tasmania. The vegetation of both areas consists of remnant temperate rainforest, dominated by trees of the austral genus *Nothofagus.*

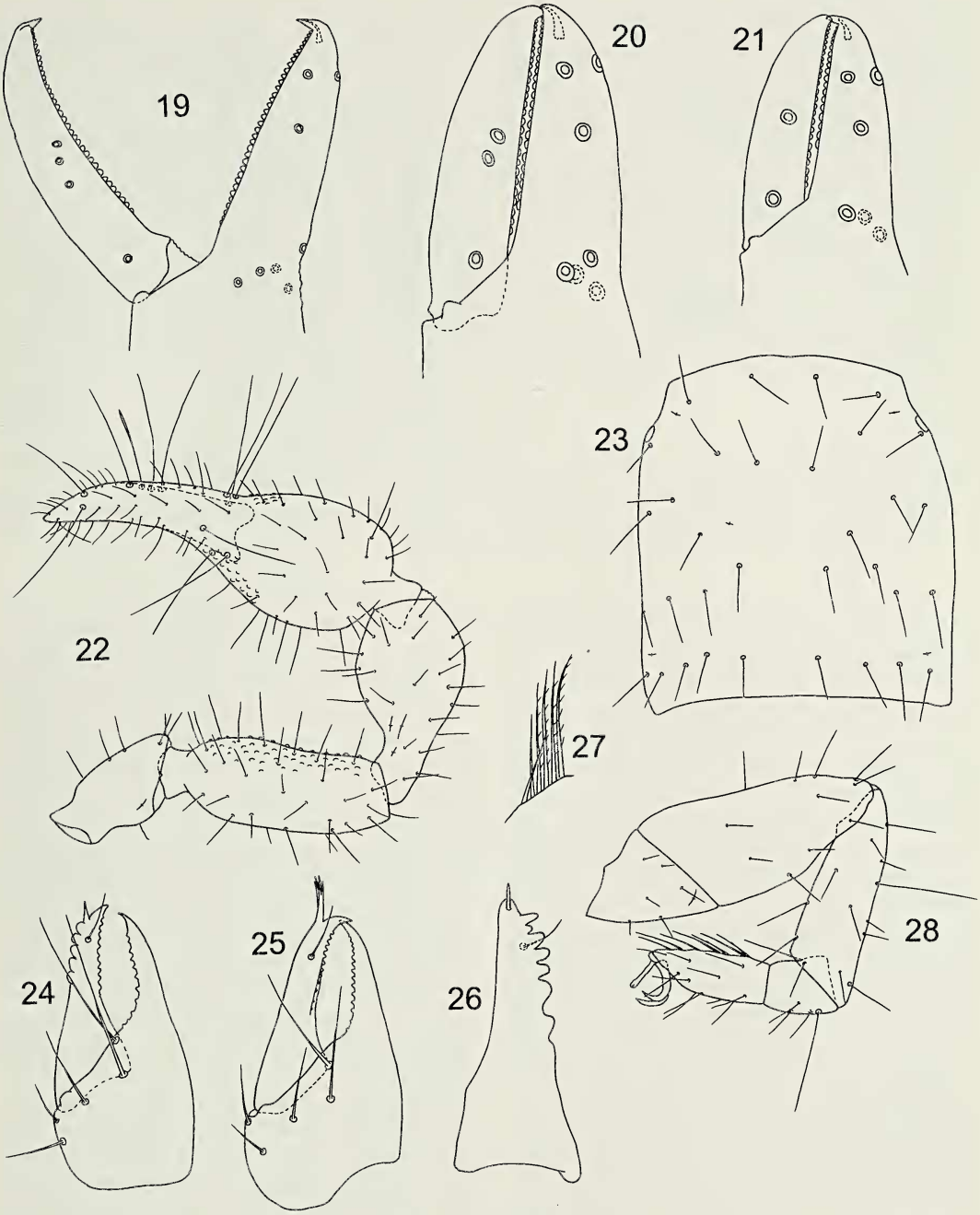
Anysrius brochus new species
(Figs. 19–31)

Types.—Male holotype, 1♀ paratype and 1 deutonymph paratype from 'Chatlee Road' site, Salmon River Forestry area, 41°04′S, 144°52′E, ex litter, '47 year old *Eucalyptus obliqua',* wet sclerophyll, 19 March 1975 (J.L Hickman et al.) (TMAG J1861, slides). Paratypes, all from **Australia:** *Tasmania:* 1♀, 1 tritonymph, 'Chatlee Road 1' site, Salmon River Forestry area, 41°04′S, 144°52′E, ground litter, '1926-planted *Eucalyptus obliqua*', 27 August 1974 (J. Madden, L. Hill, A. Skuja) (TMAG J1687, spirit); 1♀, 1 tritonymph, 'Chatlee Road 4' site, Salmon River Forestry area, 41°04′S, 144°52′E, ground litter, '1926-planted *Eucalyptus obliqua*', 27 August 1974 (J. Madden, L. Hill, A. Skuja) (TMAG J1726, spirit); 1♂, 1 deutonymph, 'Chatlee Road 8' site, Salmon River Forestry area, 41°04′S, 144°52′E, ground litter, '1928-planted *Eucalyptus obliqua*', 29 November 1974 (J.L Hickman, J.L. Madden et al.) (TMAG J1691, spirit); 1 tritonymph, 2 deutonymphs, 'Chatlee Road' site, Salmon River Forestry area, 41°04′S, 144°52′E, ex soil, '46 year old *Eucalyptus obliqua*' forest, 19 March 1975 (J.L. Hickman et al.) (TMAG J1793, spirit); 1♀, 2 tritonymphs, 2 deutonymphs, 'Chatlee Road' area, Salmon River Forestry area, 41°04′S, 144°52′E, ground litter, '1928 *Eucalyptus obliqua*', 29 November 1974 (J. Madden, J.L. Hickman et al.) (TMAG J1692, spirit).

Etymology.—The specific epithet refers to the cheliceral teeth of the male (*brochus* Latin, projection of teeth).

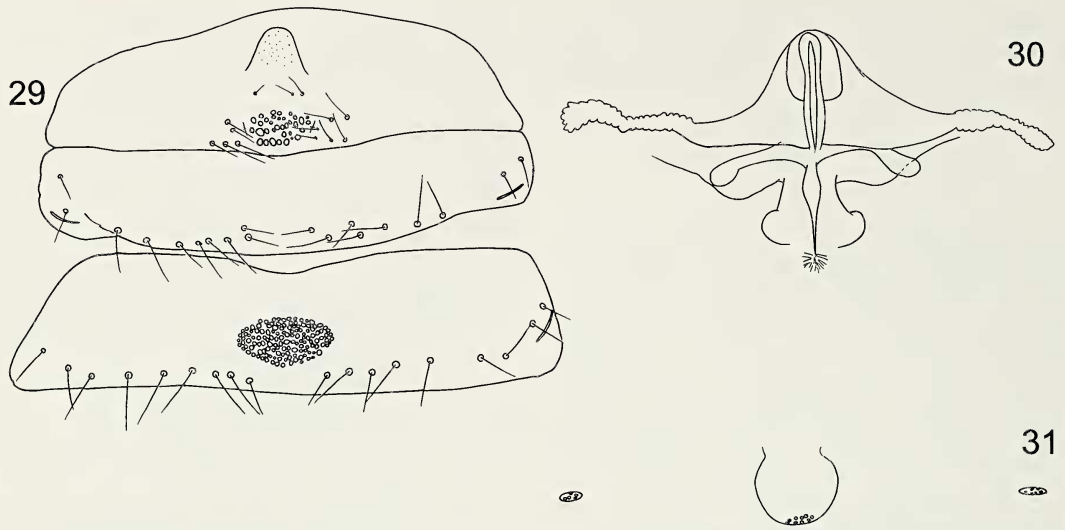
Diagnosis.—Distinguished from *A. chamberlini* by the possession of external teeth on the movable cheliceral finger of the male (Figs. 24, 26), and by the absence of specialized blunt setae on the male pedipalpal patella (Fig. 22). Females differ from those of *A. chamberlini* by the strongly granulate pedipalpal femur and chelal hand.

Description.—*Adult:* Pedipalps and carapace red-brown, legs slightly paler, remainder of body pale. Pedipalps (Fig. 22): apex of coxa rounded and with 2 setae; trochanter



Figures 19–28.—***Anysrius brochus*** new species, male holotype unless stated otherwise. 19–21, Left chelae, lateral: 19, Male; 20, Tritonymph paratype; 21, Deutonymph paratype; 22, Right pedipalp, dorsal; 23, Carapace; 24, Left chelicera, dorsal, male paratype; 25, Left chelicera, dorsal, female paratype; 26, Left movable cheliceral finger, lateral; 27, Flagellum; 28, Left leg IV.

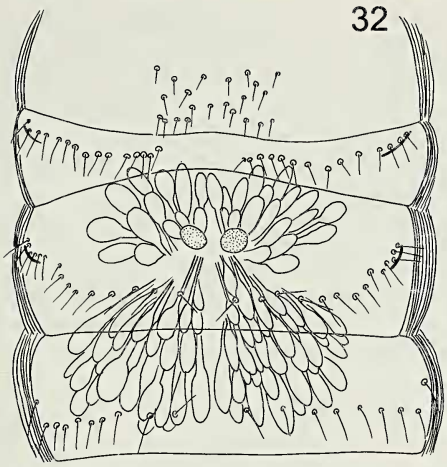
1.96 (♂, ♀), femur 2.81 (♂), 2.72 (♀), patella 1.95 (♂), 1.80 (♀), chela (with pedicel) 2.96 (♂), 3.00 (♀), chela (without pedicel) 2.73 (♂), 2.76 (♀), hand (without pedicel) 1.16 (♂), 1.31 (♀) times longer than broad, movable finger 1.37 (♂), 1.10 (♀) times longer than hand (without pedicel). Anterior face of femur, and external and internal face of chelal

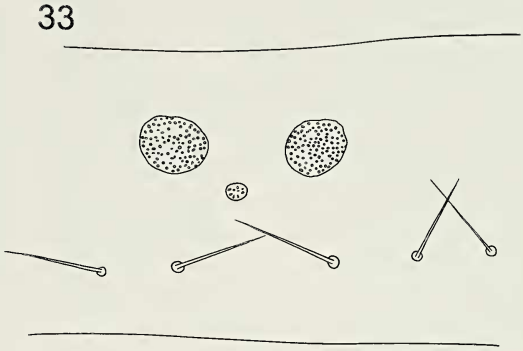


Figures 29–31.—***Anysrius brochus*** new species. 29–30, Male holotype: 29, Genital sternites, ventral; 30, Genitalia, ventral; 31, Genitalia, ventral, female paratype.

hand granulate. Fixed chelal finger with 8 trichobothria, movable chelal finger with 4 trichobothria (Fig. 19); *est, et* and *it* situated in distal portion of fixed finger, *eb, esb, ib, isb* and *ist* situated in basal portion of fixed finger; *isb* situated on internal face of fixed chelal finger; *sb, st* and *t* closely spaced, near middle of movable finger; *t* lanceolate. Chelal teeth contiguous (Fig. 19), fixed finger with 35 (♂), 32 (♀), and movable finger with 38 (♂, ♀) teeth. Chelicera (Figs. 24, 25): hand with 5 setae, movable finger with 1 sub-distal seta; fixed finger with 10 (♂), 15 (♀) teeth on inner surface; movable finger with 12 (♂), 10 (♀) teeth on inner face, dorsal surface of male with 7 lobed processes on external face (Figs. 24, 26); serrula exterior with 25 (♂), 23 (♀) lamellae; flagellum of 6 blades, the 4 distal blades with several anteriorly-directed spinules (Fig. 27); galea of ♂ small and acuminate, of ♀ trifurcate with each ramus terminally trifurcate or bifurcate. Carapace (Fig. 23) with a total of 33 (♂) or 32 (♀) setae, including 4 setae on anterior margin and 8 (♀) or 9 (♂) setae on posterior margin, 1.09 (♂), 1.01 (♀) times longer than broad; 2 small eyes, posterior pair absent. Pleural membrane generally longitudinally striate, although near cephalic region it becomes slightly granulate. Tergal chaetotaxy: ♂, 9: 12: 11: 12: 13: 13: 13: 14: 13: 12: 7: 2; ♀, i1: 10: 11: 12: 11: 13: 14: 13: 12: 12: 6: 2. Sternal chaetotaxy: ♂, 14: (2)15[0](2): (2)15(2): 13: 14: ?: ?: ?: ?: ?: 2; ♀, 5: (2)13(2): (2)10(2): 13: 13: 13: 14: 13: 10: 8: 2. Genital opercula of female not unusual; those of male (Figs. 29) with median cribrate area on sternite II and on sternite IV, sternite II with external lobe. Male genitalia (Fig. 30): lateral apodeme and lateral rod fused for entire length; ejaculatory canal atrium large; median genital sac undivided; genital atrium without internal setae. Female genitalia (Fig. 31) with 1 circular median and 2 small lateral cribriform plates, with very few pores; spermathecae absent. Legs (Fig. 28): moderately stout; leg I with femur 1.44 (♂), 1.07 (♀) times longer than patella; junction between femur I and patella I nearly perpendicular; femur + patella IV 2.93 (♂), 2.72 (♀) times longer than deep; junction between femur IV and patella IV strongly oblique; tibia IV 3.28 (♂), 3.17 (♀) times longer than deep; tibia and metatarsus IV each with single subproximal tactile seta; subterminal tarsal seta acuminate; arolium not divided distally, slightly shorter than claws.

Dimensions (mm), holotype ♂ (paratype ♀): Body length 1.52 (1.63). Pedipalps: trochanter 0.275/0.140 (0.275/0.140), femur 0.435/0.155 (0.435/0.160), patella 0.390/0.200 (0.360/0.200), chela (with pedicel) 0.725/0.245 (0.765/0.255), chela (without pedicel) 0.670 (0.705), hand length (without pedicel) 0.285 (0.335), movable finger length 0.390





Figures 32–33.—*Syarinus obscurus* (Banks), male from E. of Canjilon, Rio Arriba County, New Mexico, USA; 32, Anterior sternites and glands associated with cribrate areas on sternite IV, ventral; 33, Sternite IV, ventral.

(0.370). Chelicera 0.255/0.125 (0.275/0.145), movable finger length 0.185 (0.200). Carapace 0.445/0.410 (0.415/0.410); diameter of eye 0.025 (0.025. Leg I: femur 0.180/0.090 (0.145/0.100), patella 0.125/0.085 (0.135/0.100), tibia 0.185/0.065 (0.160/0.065), metatarsus 0.080/0.050 (0.085/0.060), tarsus 0.125/0.050 (0.110/0.055). Leg IV: femur + patella 0.410/0.140 (0.395/0.145), tibia 0.295/0.090 (0.285/0.090), metatarsus 0.100/0.065 (0.095/0.070), tarsus 0.160/0.060 (0.145/0.060).

Tritonymph: Pedipalps: trochanter 1.92, femur 2.52, patella 1.87, chela (with pedicel) 2.83, chela (without pedicel) 2.64 times longer than broad. Fixed finger with 7 trichobothria, movable finger with 3 trichobothria (Fig. 20); *eb, esb, est, et, ib, ist, it, b, sb* and *t* present, *t* lanceolate and shorter than other trichobothria. Chelicera: galea trifurcate, each ramus terminally trifurcate; hand with 5 setae, movable finger with 1 seta; fixed finger with 11 teeth, movable finger with 11 teeth; flagellum composed of 6 blades, the 3 distal blades with several anteriorly-directed spinules. Carapace 1.03 times longer than broad; epistome absent; one pair of small eyes present; with 25 setae including 4 setae on anterior margin and 7 setae on posterior margin. Legs as in adult.

Dimensions (mm): Body length 1.455. Pedipalps: trochanter 0.230/0.120, femur 0.340/0.135, patella 0.290/0.155, chela (with pedicel) 0.595/0.210, chela (without pedicel) 0.555, hand length (without pedicel) 0.270, movable finger length 0.305. Carapace 0.405/0.395.

Deutonymph: Pedipalps: trochanter 1.95, femur 2.57, patella 1.83, chela (with pedicel) 2.84, chela (without pedicel) 2.66 times longer than broad. Fixed finger with 6 trichobothria, movable finger with 2 trichobothria (Fig. 21); *eb, est, et, ib, ist, it, b* and *t* present, *t* lanceolate and slightly shorter than other trichobothria. Chelicera: galea trifurcate, each ramus terminally bifid; hand with 5 setae, movable finger with 1 seta; fixed finger with 7 teeth, movable finger with 8 teeth; flagellum composed of 6 blades, the 4 distal blades with several anteriorly-directed spinules. Carapace 0.94 times longer than broad; epistome absent; one pair of small eyes present; with 22 setae including 4 setae on anterior margin and 6 setae on posterior margin. Legs as in adult.

Dimensions (mm): Body length 1.265. Pedipalps: trochanter 0.185/0.095, femur 0.270/0.105, patella 0.220/0.120, chela (with pedicel) 0.455/0.160, chela (without pedicel) 0.425, hand length (without pedicel) 0.215, movable finger length 0.230. Carapace 0.320/0.340.

Remarks.—*A. brochus* is known only from a single locality in north-western Tasmania.

Syarinus Chamberlin
(Figs. 32–33)

Syarinus Chamberlin 1925: 329; Harvey 1991a: 429 (full synonymy). Type species: *Ideoroncus obscurus* Banks 1893, by original designation.

Diagnosis.—Distinguished from all Syarinidae, except *Anysrius,* by the position of trichobothrium *isb* which is situated on internal face of fixed chelal finger, apex of pedipalpal coxa rounded and with 2 setae, the strongly oblique junction between femur and patella IV, subterminal tarsal seta acuminate, and male sternite IV with median cribrate area (Fig. 33) and associated glands (Fig. 32). *Syarinus* differs from *Anysrius* by male sternite II lacking an external lobe and median cribrate area, and the divided median cribrate area of male sternite IV (Fig. 33).

Description.—Pedipalps: apex of coxa rounded and with 2 setae; chelal fingers curved; chelal teeth contiguous; venom apparatus absent from movable finger; venom duct of fixed finger short. Fixed chelal finger with 8 trichobothria, movable chelal finger with 4 trichobothria; trichobothria *est, et* and *it* situated in distal portion of fixed finger, *eb, esb, ib, isb* and *ist* situated in basal portion of fixed finger; *isb* situated on internal face of fixed chelal finger; *sb, st* and *t* closely spaced near middle of movable finger; *t* lanceolate. Chelicera: hand with 5 (occasionally 6 or 7) setae, movable finger with 1 sub-distal seta; movable finger of ♂ with teeth all grouped distally; flagellum composed of 7 (sometimes 8, but only 6 in *S. strandi*) blades, all but the most basal blade with several anteriorly-directed spinules; galea of ♂ small and usually acuminate, that of ♀ trifurcate with each ramus terminally trifurcate or bifurcate. Carapace: subquadrate, with 1 pair of eyes, anterior eyes small and flat, posterior eyes absent. Pleural membrane generally longitudinally striate. ♂ sternite II without modifications; ♂ sternite IV with divided median cribrate area (Fig. 33) and with associated glands (Fig. 32). Male genital atrium without setae. Female genitalia with 1 median and 2 small lateral cribriform plates, with very few pores; spermathecae absent. Legs: junction between femur and patella I nearly perpendicular; junction between femur and patella IV strongly oblique; metatarsus and tarsus of all legs separate; subterminal tarsal seta acuminate; arolium slightly shorter than claws (except in *S. strandi*).

Material examined.—*Syarinus enhuycki* Muchmore 1968: 3♀, 5 tritonymphs, 3 deutonymphs (all paratypes), E.N. Huyck Preserve, Rensselaerville, Albany County, New York, USA (AMNH, slides).

Syarinus granulatus Chamberlin 1930: 1♀, Cowles, New Mexico, USA (AMNH, S-2161, slide); 2♀, near Sandia Crest, Sandia Mts, Bernalillo County, New Mexico, USA (AMNH, S-1754, S-2145.1, slides); 1♀, 1 tritonymph, Eau Pleine Reserve, Marathon County, Wisconsin, USA (AMNH, S-2364.2, S-2346.7, slides).

Syarinus obscurus (Banks 1893): 1♂, E. of Canjilon, Rio Arriba County, New Mexico, USA (AMNH, S-1911.3, slide); 2♂4♀, Samuel P. Taylor State Park, Marin County, California, USA (FSCA, WM5030); 3♂2♀, Yuba Pass, Sierra County, California, USA (FSCA, WM5037).

Included species.—*Syarinus enhuycki* Muchmore 1968, *S. granulatus* Chamberlin 1930, *S. honestus* Hoff 1956, *S. obscurus* (Banks 1893), *S. palmeni* Kaisila 1964 and *S. strandi* (Ellingsen 1901).

Distribution.—Species of *Syarinus* are generally restricted to montane biotopes in the Holarctic region, but there are lowland records from more northern latitudes. Of the montane species, *S. enhuycki* is found in the northern parts of the Appalachian Mountains (Muchmore 1968), with outlying populations in Michigan (Nelson 1975) and possibly Wisconsin, based upon a single collection identified as *S. granulatus* by Hoff & Bolsterli (1956) (see Muchmore 1968). Three species are mostly restricted to the Rocky Mountains: *S. honestus,* which is known from a single locality in New Mexico at 10,250 ft (=3124 m) (Hoff 1956); *S. granulatus,* which has been reliably recorded only from Colorado (Chamberlin 1930) and New Mexico (Hoff 1956); and *S. obscurus* which has been recorded from Canada (British Columbia, Saskatchewan) and USA (California, Montana, New Mexico, Utah, Washington, Wyoming) (see Harvey 1991a). Of the remaining two species, *S. palmeni* is known only from a single locality in Newfoundland (Kaisila 1964), and *S. strandi* has been taken from six different localities in northern Europe (Austria, Finland, Norway and Germany). Muchmore (1990) also records members of the genus from Minnesota, Oregon and Ontario.

Remarks.—*Syarinus,* the type genus of the Syarinidae, is currently known only from North America and northern Europe. It has been diagnosed by Chamberlin (1930) and Hoff (1956), and good descriptions of new or previously poorly known species were provided by Chamberlin (1930), Hoff (1956), Kais-

ila (1964), Muchmore (1968), Mahnert (1976), Schawaller (1987) and Schmarda (1997). Although males appear to be relatively rare in museum collections, it is somewhat surprising that the peculiar morphology of the male sternite IV described and illustrated here has not been noticed by previous authors. The discovery of two or more cribrate areas on sternite IV and associated glands on males of at least three species of *Syarinus* raises the possibility that this character state is present in all species of the genus. However, I have not had the opportunity to examine males of *S. granulatus, S. strandi* and *S. palmeni,* and any discussion on the distribution of this character state must await a more detailed review of all species attributed to the genus. In addition, it appears that males of *Syarinus* species share another unique feature, whereby the teeth of the movable cheliceral finger are grouped near the level of the galeal seta in *S. granulatus, S. honestus, S. obscurus* and *S. enhuycki* (e.g., Chamberlin 1931, fig. 13M; Hoff 1956: 11, 15; Muchmore 1968: 113). Once again, the utility of this feature will remain unknown until males of *S. palmeni* and *S. strandi* are more fully described.

DISCUSSION

Morphology.—Some of the features that occur in species of *Anysrius* and at least some species of *Syarinus* are of extreme interest and occur nowhere else in the Pseudoscorpiones.

The dorsal 'teeth' on the movable cheliceral finger of male *A. brochus* are unparalleled within the order, as are the specialized blunt setae on the pedipalpal patella of male *A. chamberlini.* The modifications of sternite II of male *Anysrius* species, with an external lobe and cribrate area, are similarly unique to this genus. The cribrate area of sternite IV is restricted to *Anysrius* spp. as well as to males of *S. obscurus* and *S. honestus* (Harvey pers. obs.) and *S. enhuycki* (W.B. Muchmore *in litt.*), but in the two *Syarinus* species examined the cribrate area is divided into two, or rarely three, separate regions (Fig. 33) whereas it is a single region in *Anysrius* spp. (Figs. 16, 29). The nature of sternite IV has not been ascertained for the remaining species of *Syarinus* (*S. granulatus, S. palmeni* and *S. strandi*) and males must be reexamined to determine whether they can be retained in the genus *Syarinus,* since the lack of this character state requires that any species concerned would probably need to be placed in a new genus situated as the sister-group to the *Anysrius* + *Syarinus* clade.

The cribrate area of sternite IV in *Syarinus* is associated with a large number of glands, all apparently discharging via the cribrate area (Fig. 32). Despite close examination of males of *A. chamberlini* and *A. brochus,* a similar glandular system could not be detected in the Tasmanian forms.

Abdominal modifications are known in other syarinid genera, but these take on quite different forms and are not considered homologous with the features found in *Syarinus* and *Anysrius.* These include the gland openings found on sternite VI in some males of *Chitrella* and *Pseudoblothrus* (e.g., Chamberlin 1931; Vachon 1954), and the small circular structures suspected to be glandular pores situated in the intersegmental membranes of *Pseudoblothrus peyerimhoffi* (Simon 1905) and *P. strinatii* Vachon 1954 (Vachon 1952, 1954).

Biogeography.—The occurrence of related syarinid genera in Tasmania, North America and northern Europe, without any potentially related genus occurring in the intervening tropical latitudes, can only be explained by one of two hypotheses: dispersal or vicariance. The dispersal model requires a rigid set of conditions which would be extremely demanding upon an organism as small and relatively immobile as a pseudoscorpion which prefers temperate forest litter. The ancestor to either *Anysrius* or *Syarinus* would have dispersed across one or more large expanses of water, the Pacific Ocean, to colonize Tasmania from the Holarctic zone, or vice versa. While some pseudoscorpions, including *Syarinus* (see Kaisila 1949; Muchmore 1971), exhibit phoretic behavior, whereby they attach themselves to flying insects, which may result in dispersal, it seems unlikely that large-scale ocean crossings are possible or are likely to result in successful breeding amongst conspecifics after the colonizing event has occurred. If this scenario were possible, a wider distribution of the Tasmanian species would seem likely. Despite the examination of numerous Tasmanian pseudoscorpions over the past 20 years, I have not encountered any material from outside of the two localities listed above. In addition, representatives of neither of these

syarinid genera have been found in intervening areas, despite the examination of thousands of pseudoscorpions from Australia and nearby areas, including the islands of the southwest Pacific, by the author.

Therefore, the remaining hypothesis, that the modern distribution is the result of vicariance events dating back to the Mesozoic (*ca.* 170 million ybp) when Pangea was still intact (Smith et al. 1994), is the preferred scenario. As argued by numerous different authors studying relatively immobile organisms (e.g., Brundin 1966; Platnick 1975), the most parsimonious explanation for such distribution patterns involves the rejection of a dispersalist model and the acceptance of the great age of these clades of organisms which predate the geological movements of the continents which now separate them.

An identical scenario must be evoked for the Pseudogarypidae, which have a remarkably similar distribution pattern to that of the *Syarinus-Anysrius* clade (Recent species in Tasmania and North America, with three Tertiary species recorded from European Baltic Amber). These Pangean clades of pseudoscorpions with distinct bipolar distributions are quite rare and serve to illustrate that the common ancestor to the *Syarinus-Anysrius* clade must have evolved prior to the breakup of Pangea during the Mesozoic.

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